

**CONFIRMED MINUTES**  
**IHRA SIDE IMPACT WORKING GROUP**

**9<sup>th</sup> MEETING**

**INRETS, LYON, FRANCE**

**25-26 SEPTEMBER 2000**

**1. ATTENDEES**

Keith Seyer	(Chair)	Department of Transport & Regional Services, Australia
Craig Newland	(Secretary)	Department of Transport & Regional Services, Australia
Dainius Dalmotas		Transport Canada
Suzanne Tylko		Transport Canada
Richard Lowne		EEVC
Joseph Kaniyanthra		National Highway Traffic Safety Administration, USA
Michael Leigh		OICA North America / AAM
Rainer Justen		OICA Europe
Takahiko Uchimura		OICA Asia Pacific / JASIC / JAMA
Haruo Ohmae		JARI
Takeshi Harigae		JASIC / JARI
Minoru Sakurai		JASIC / JARI
Hideki Yonezawa		JMoT
Frederic Robinet		AFL Honeycomb Structures (Day 1)
Celine Adalian		INRETS
Sabine Compigne		INRETS

Michael Leigh was introduced as the new representative for OICA North America, replacing Bob Hultman (retired).

Mr Harigae and Mr Sakurai were introduced as the new representatives from JARI. Mr Ohmae (JARI) was also present for this meeting to hand over to the new JARI delegates. JMoT indicated that they would like to use Mr Ohmae as an advisor at future meetings.

**APOLOGIES**

Nil.

**2. MODIFICATIONS TO AGENDA**

Item 5 (Report from IHRA Biomechanics Working Group) was deleted as the BWG has not met since the last IHRA Side Impact Working Group meeting.

Item 6.1 Global Accident Data presented by Transport Canada was added.

Item 6.2 Information regarding the sources of head injury in side impact crashes presented by Mr Lowne was added.

The title of Item 8.2 was clarified to be: Results from OOP and dynamic effectiveness tests for side airbags.

Item 8.5 ES-2 test results from Japan was added.

Item 8.6 EEVC test results using modified ECE barrier faces was added.

Item 11 was amended to include a discussion on the distribution of working group documents and publication on the IHRA website.

The revised agenda was accepted as amended. The modified agenda has Document Number SIWG 100 rev 2.

### **3. MINUTES OF THE PREVIOUS MEETING**

The draft minutes of the eighth meeting, held in London were amended, approved and confirmed. The confirmed minutes have document number SIWG 98 Rev 2.

### **4. REPORT FROM WORLDSID TASK GROUP**

Mr Uchimura delivered an update on the activities of the WorldSID Task Group. The complete prototype dummy has been assembled. The group is currently working on the instrumentation. Component tests are scheduled for mid-September, with the DTS data acquisition system to be ready shortly after this time.

The workshop to be held in Australia in December 2000 is intended to demonstrate assembly, disassembly and use of the dummy, as well as trial the dummy under crash conditions. The workshop will involve crash tests on 01 and 08 December 2000 and a sled test during the week of 04-08 December 2000 to be conducted at Autoliv Australia. Meeting/conference activities will be held at Ford (situated near Autoliv). Members of the IHRA Side Impact and Biomechanics Working Groups will be invited to attend the workshop.

To assist with finance, the possibility of each region purchasing 2 WorldSID dummies has been discussed. Final cost for dummies has not yet been decided.

The WorldSID task group intends to publish papers on the WorldSID at the IRCOBI, Stapp and ESV conferences. A task group meeting has been scheduled for June 2001 in Amsterdam, with a subsequent meeting to be held around September in the Asia/Pacific region.

### **5. REPORT FROM IHRA BIOMECHANICS WORKING GROUP**

(Item deleted).

## 6. PRESENTATION OF ACCIDENT STUDIES

### 6.1 Global Accident Data

Mr Dalmotas presented an updated analysis of global accident data. This work had been undertaken for the IHRA Biomechanics Working Group, and is intended to be referenced in the IHRA SIWG report due at ESV 2001. This document has number SIWG 102.

An analysis of unweighted (frequency of crash type) US NASS data looking at vehicle to vehicle side impact crashes shows that in half of the cases with serious and fatal injuries the striking vehicle is an LTV. Passenger car occupants are over-represented as injured victims and LTVs are over-represented as bullet vehicles. US FARS data from 1998 showed that in vehicle to vehicle side impact crashes females comprised 55%, whereas males represented 45% of the fatalities. An analysis of NASS data also showed that for single vehicle side impact crashes, the frequency of injuries to males (71%) was much higher than that to females (29%).

Data from the Combined Crash Injury Study (CCIS) from the UK revealed that in side impact car to car crashes, females represented 62% of MAIS 3+ injuries; males represented 38%.

Based on the global crash data, Mr Dalmotas reiterated his proposal that a 5<sup>th</sup> percentile female driver dummy would be most appropriate for a mobile barrier to vehicle side impact test, and a 50<sup>th</sup> percentile adult male driver dummy would be most appropriate for a vehicle to pole side impact test.

Japan stated that they were not willing to restrict themselves to using a 5<sup>th</sup> percentile female dummy in an MDB to vehicle test as the Japanese data showed almost the same proportions of males and females injured in car to car side impact crashes.

Mr Lowne pointed out that field accident data shows a wide range of contact locations for the head and noted that it would be impractical to strike all possible contact points with the dummy head in an MDB to vehicle test. For this reason, he advocated the use of a subsystem test to assess head protection for contact to the vehicle interior.

Mr Dalmotas replied that head contacts in real crashes are to deformed structures, which are not evaluated in the FMVSS 201 subsystem test.

Mr Dalmotas was requested to provide a copy of the presentation on Global Accident data and the Transport Canada procedures for dummy positioning to Mr Newland for distribution to the group.

## **6.2 Sources of head injury in side impact crashes**

The EEVC is considering raising of the ground clearance of the mobile barrier deformable barrier face. This also requires consideration of the overall height of the barrier (which determines the height of the top of the barrier from the ground).

Mr Lowne presented an analysis of a number of European crashes in which head injuries occurred due to contact with exterior objects (Document number SIWG 103). The intent of the study was to quantify the number of head injuries caused to occupants of struck passenger cars by contact to a striking SUV.

For AIS 3+ injuries (21 cases), 10% of head injuries due to exterior contact were attributed to SUVs.

For AIS 4+ injuries (17 cases), 12% of head injuries due to exterior contact were attributed to SUVs.

For AIS 5+ injuries (10 cases), 0% of head injuries due to exterior contact were attributed to SUVs.

Therefore it was suggested that Europe does not have the same SUV/LTV to passenger car side impact concerns as noted by the US and that (for Europe) an increase in ground clearance of the deformable barrier face should be achieved without increasing the height from the ground of the top of the barrier face.

## **7. GEOMETRIC STUDIES OF THE FLEET**

### **7.1 Australian vehicle fleet composition**

Mr Newland presented some information regarding the composition of the Australian vehicle fleet (document SIWG 104). The most recent information from the Australian Bureau of Statistics, 31 October 1998 shows that there were 11.7 million registered vehicles in Australia, 81% of these were passenger vehicles and 14% Light Commercial Vehicles (Light Trucks and Vans). The States and Territories of Australia are responsible for registration of vehicles, however, they do not use a common or central database for this purpose. Therefore an accurate current picture of the Australian fleet based on registered vehicles was unavailable. Information of new vehicle sales for the period 1991 – 1999 was used to estimate the fleet composition and monitor trends.

The main points from the analysis are:

The proportions of MPVs, light passenger cars and medium passenger cars are not changing. The proportion of light (unibody) 4 wheel drive vehicles is increasing rapidly. The proportion of large passenger cars is decreasing slightly and small passenger cars decreased, but are now increasing again.

Mr Dalmotas suggested it may be useful to combine vehicle crash data and vehicle fleet data to investigate whether the types of vehicles involved in crashes are representative of the fleet as a whole, or whether certain vehicle types are over-represented.

### **7.2 US average fleet mass**

Mr Kanianthra presented some US data (document SIWG 105) showing that in 1999, passenger cars made up 56.5% of the US fleet and LTVs made up 43.5%.

The percentage of cars had decreased in the period 1990-1999; the corresponding percentage of LTVs had increased.

The average mass (kerb mass + 300lb) of the passenger cars was found to be 3418 lb and for the LTVs was found to be 4530 lb.

The combined US weighted average fleet mass was calculated as 3902 lb, but was expected to increase in future assuming a continuation of the trend of an increasing proportion of LTVs.

## **8. TEST RESULTS AND TEST MATRICES**

### **8.1 Behaviour of Aluminium honeycomb under shear loading (Australia)**

Mr Newland gave an update (document SIWG 106) on a series of tests designed to evaluate the performance of aluminium honeycomb under combined axial and shear loads. Only 2 tests have been conducted to date. Force-deflection curves for these tests have not been able to be calculated due to instrumentation difficulties. Further tests will be conducted with modifications intended to overcome this problem.

### **8.2 Results from OOP and dynamic effectiveness tests for side airbags (NHTSA)**

Mr Kanianthra briefly discussed the NHTSA Side Airbag Evaluation Program (document SIWG 107).

There are currently several vehicles on the US market with rear seat thorax side airbags.

Mr Kanianthra noted that OOP results are sensitive to position and test vehicle. He further noted that the positions recommended by the SAB OOP Technical Working Group final report, 'Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags' did not always represent "worst case" as worst case was dependent on the design of the vehicle and side airbag system.

NHTSA plan to conduct side airbag effectiveness tests using SIDIIIs. This evaluation will be conducted using identical vehicles, but with and without side airbags.

Mr Lowne queried whether performance (effectiveness) of side airbags had been degraded to meet OOP requirements. This issue was not explored or discussed.

Mr Dalmotas and Mr Leigh commented that vehicle structural changes are needed to improve thorax protection and side airbags are used for "fine tuning".

### **8.3 US analysis of struck vehicle velocity on injury outcome (NHTSA)**

Mr Kanianthra presented some information (document SIWG 108) based on 1988-1997 NASS data (LHS impacts, with no rollover) for crashes resulting in MAIS 3+. The cumulative distribution of the lateral velocity change of the struck vehicle showed that the 50<sup>th</sup> percentile value was 15-20 mph. Mr Dalmotas expressed

concern that both struck and non-struck side data were included in this analysis and suggested that these should be treated separately.

Mr Seyer pointed out that this did not provide any information to assist in deliberations regarding the need (or otherwise) to crab the MDB.

Mr Lowne reminded the group that previous data from Japan had showed struck vehicle longitudinal velocity to have no effect on side impact injury outcome at impact speeds considered by IHRA.

Mr Kaniyanthra was requested to re-analyse the data to look at the influence of longitudinal velocity of the struck vehicle on side impact injury severity.

#### **8.4 DoTRS/TC parametric study – supplementary test to examine effect of bullet mass (Australia)**

Mr Newland presented the results of a test designed to evaluate the effect of MDB mass on dummy injury measures (document SIWG 109).

In the previously reported DoTRS/Transport Canada side impact parametric test series, trolley mass had been varied within practical limits (a “light” mass of 950kg and a “heavy” mass of 1365kg). However, since the target vehicle (Ford EL Falcon) standard mass was 1765kg, the bullet/target mass ratios were 0.53 and 0.77 respectively. In order to achieve a bullet/target mass ratio greater than 1, a test was conducted using a 1365kg MDB and a stripped Ford EL Falcon (engine, drivetrain and some non-struck side components removed) with a test mass of 1045kg (bullet/target mass ratio of 1.3). However, there was some concern regarding the change in centre of gravity and moments of inertia of the stripped vehicle and the unknown effects this may have on the result.

Therefore, a supplementary test was conducted to investigate the effect of MDB mass. Ford supplied results of a “EuroNCAP” side impact test for the Ford Ka (950kg 50 km/h perpendicular MDB, Cellbond Multi 2000 version 15 deformable barrier face, 1009kg Ka, EuroSID-1 dummy). The conditions of this test were reproduced, with the exception of ballasting the MDB trolley to 1365kg. This resulted in a change in bullet/target mass ratio from 0.94 to 1.35.

There was an increase in the head injury metric in the test with the 1365kg trolley. The HIC36 value was observed to increase from 220 to 400, however, due to the low HIC values, this does not represent a significant increase in the risk of head injury. All other injury metrics were essentially unchanged.

This result conflicts with the earlier Ford Falcon tests in which an increase in bullet/target mass ratio from 0.77 to 1.3 resulted in increased injury risk in the thorax and abdomen. However, these tests used a BioSID dummy in the driver position. The influence of dummy type on the result was also unclear.

Further test/s were suggested to clarify this issue. Australia undertook to consider the most suitable test and conduct a further test to provide more insight on the issue of MDB mass.

## **8.5 ES-2 test results (Japan)**

Mr Ohmae presented the results of tests using the ES-2 dummy (document SIWG 110). The dummy has been used in full scale crash tests using a small passenger car and a medium passenger car (both ECE R95 compliant vehicles) in crabbed and non-crabbed tests. These results have been compared against the same tests using EuroSID-1.

In the non-crabbed tests, the ES-2 showed slightly higher HPC and pubic force than EuroSID-1. V\*C results using the ES-2 were also higher than those using EuroSID-1. Rib deflections for the ES-2 and EuroSID-1 dummies were quite similar. The abdominal force recorded on the EuroSID-1 was slightly higher than that on the ES-2.

The results from the crabbed tests showed HPC, pubic force and abdominal force were all slightly higher for the EuroSID-1 than ES-2. The ES-2 recorded higher rib deflections and V\*C values than EuroSID-1.

Japan have also conducted thorax, abdomen and pelvis impactor tests on ES-2. These showed similar results to EuroSID-1, however, the rebound of the ribs was faster on ES-2, and some negative rib deflections were measured after the rib rebound.

## **8.6 EEVC test results using modified ECE barrier faces**

Mr Lowne reported on the preliminary results of some tests conducted to evaluate modified ECE barrier face designs. The results have not yet been properly analysed and are not yet available for distribution, however, this information has been assigned document number SIWG 111.

Four tests were conducted using a Renault Megane as the target vehicle. The MDB tests were compared to a baseline car to car test - 30 mph Ford Mondeo bullet vehicle into a 15 mph Megane. The Mondeo has a frontal width of around 1400mm and mass of 1390kg.

The first modified ECE barrier used centre blocks 186mm wider than standard (i.e. overall barrier face width 1686mm), and had 50mm of material removed from the bottom of the barrier to increase the ground clearance.

The second modified barrier was similar to the first, but had only the leading 180mm of material removed from the bottom of the barrier. This was intended to simulate an initial ground clearance of 350mm, but with a front lateral with a 300mm ground clearance situated 180mm from the front face of the barrier.

Tests were run with these modified barrier faces fitted to a 950kg ECE R95 trolley. A test was also conducted using the second modified barrier face on a 1500kg MDB. An effect of trolley mass increasing the injury measures was noted.

## **9. ISSUES TO BE ADDRESSED IN PROPOSED ELEMENTS OF IHRA SIDE IMPACT TEST PROCEDURE**

(Nil).

## **10. DISCUSSION OF IHRA SIDE IMPACT WORKING GROUP ESV REPORT**

The group worked through the report. The document was edited “on the spot”, with the document projected for all the group to see. The amended document has been sent to John Hinch for circulation to the IHRA Steering Committee. This document has reference number SIWG 112.

## **11. OTHER BUSINESS**

The issue of information posted on the IHRA website was again discussed. Mr Kanianthra reiterated that NHTSA were unable to guarantee the protection of confidential IHRA information from a Freedom of Information (FOI) request. Mr Lowne suggested the possibility of using a more secure website (in another country) where the information could be protected from FOI, with a link to this website from the NHTSA IHRA website. The feasibility and legal standing of this option is to be investigated by Mr Kanianthra.

The IHRA SIWG agreed to post confirmed minutes, progress reports and the ESV 2001 paper (when finalised) on the public side of the NHTSA IHRA website. Mr Newland to send relevant documents to NHTSA for posting on the website.

## **12. NEXT MEETING**

The next meeting will be on Monday 11 and Tuesday 12 December (the week following the WorldSID workshop) in Canberra, Australia.

## **13. MEETING CLOSED.**

CRAIG NEWLAND

13 December 2000